STRIPPABLE LAMINATE FINISH

Technical Field

This invention relates to a strippable laminate finish, a strippable laminate finish kit, and methods for applying and for removing a finish.

Background

UV light curable coating compositions typically provide a desirable combination of properties including rapid cure, high gloss and good durability. Due to these properties and their generally good scratch and detergent resistance, UV light curable coating compositions have been used as floor finishes. Eventually even a UV light cured floor finish will show the effects of wear, and will require removal and renewal. UV cured floor finishes generally are not regarded as being removable using conventional chemical floor stripping agents. Instead, more aggressive removal techniques such as floor sanding or aggressive burnishing may be employed, thereby leading to removal of a portion of the underlying floor surface. This has discouraged the use of UV cured floor finishes.

Summary of the Invention

The present invention provides, in one aspect, a coated substrate comprising a strippable intermediate coating atop the substrate, and a strip agent-permeable coating atop the intermediate coating, wherein the strip agent-permeable coating is less strippable and more wear-resistant than the intermediate coating. In a preferred embodiment, the substrate comprises a floor, the strip agent-permeable coating comprises a UV curable floor finish, the intermediate coating comprises a metal-crosslinked acrylic, and the strip agent comprises a chemical strip agent containing a phenyl alcohol.

The strip agent-permeable coating (which in the interest of brevity could be referred to as the topcoat, even though it may itself be overcoated with one or more other layers) protects the underlying intermediate coating and substrate from abrasion, dirt, and other environmental effects. When the topcoat eventually becomes worn and must be renewed, a strip agent (e.g., chemical strip agent) can be applied to the topcoat whereupon the strip agent will penetrate the topcoat and attack the underlying intermediate coating. The intermediate coating breaks down due to the action of the strip agent, thereby

enabling removal of the intermediate coating and topcoat without the need for the use of aggressive removal techniques such as floor sanding or aggressive burnishing.

In another aspect, the invention provides a strippable laminate finish kit, comprising one or more containers of a strippable intermediate coating and a strip agent-permeable topcoat, wherein the topcoat is less strippable and more wear resistant than the intermediate coating. The strippable laminate finish kit optionally includes a strip agent.

In a further aspect, the invention provides a strip agent concentrate containing a polar solvent that is denser than water, and a sufficiently low level of cosolvent or surfactant so that upon mixing with water a pseudo-stable aqueous dispersion forms which will phase-separate following application to a surface.

In a further aspect, the invention provides a method for applying a finish to a substrate, comprising the steps of applying to the substrate a strippable intermediate coating, allowing the intermediate coating to dry or harden, and applying a strip agent-permeable topcoat to the intermediate coating, wherein the topcoat is less strippable and more wear resistant than the intermediate coating.

In yet a further aspect, the invention provides a method for removing a multilayer laminate finish having a topcoat and an intermediate layer atop a substrate, comprising the steps of applying to the topcoat a strip agent (e.g., a chemical strip agent), allowing the strip agent to permeate through the topcoat to attack the intermediate layer, and removing the intermediate layer and topcoat by mopping, vacuuming, mild abrasion or other measures that do not remove substantial portions of the underlying substrate.

Brief Description of the Drawing

Fig. 1 shows a view in cross-section of a floor coated with a laminate finish of the invention.

Fig. 2 shows a view in cross-section of a wall coated with a laminate finish of the invention.

Fig. 3 shows a view in cross-section of the application of a chemical strip agent to a laminate finish in the invention.

Fig. 4 shows a view in cross-section illustrating removal of a laminate finish of the invention.

Detailed Description

As used in connection with this invention, a coating is regarded as being "strippable" if when subjected to the action of a suitable strip agent, the coating can readily be removed from the substrate using simple, non-abrasive measures such as a mop and detergent solution, or mildly abrasive but substrate-non-damaging measures such as a nonwoven floor scrub pad. Strippability preferably is evaluated using the Second Strippability Evaluation Method (7 point scale) set out below in the Example section, using Test Strip Agent K and a 10 minute strip agent standing time.

As used in connection with this invention, a topcoat is regarded as being "strip agent-permeable" if when coated atop the desired strippable coating and subjected to the action of a suitable strip agent, the strip agent permeates or otherwise penetrates the topcoat sufficiently so that the both the topcoat and strippable coating can be removed from the substrate. Strip agent permeability can be enhanced by a mechanically roughening the topcoat (using, for example, a nonwoven floor scrub pad, brush or other mild abrasive measure) just prior to stripping. A topcoat will be regarded as being strip agent-permeable even if such mechanical roughening is required, so long as the required mechanical roughening does not damage the underlying substrate.

As used in connection with this invention, a topcoat is regarded as being more wear resistant than an underlying strippable intermediate coating when the topcoat exhibits lower weight loss than the underlying intermediate coating using a Taber Abrasion test conducted according to ASTM D4060-95.

Referring now to Fig. 1, floor 10 is overcoated with laminate finish 11 containing intermediate coating 12 and topcoat 14. Topcoat 14 is a UV-curable floor finish whose wear resistance and durability protect underlying intermediate coating 12 and floor 10 from dirt, scuffing and other environmental factors. Intermediate coating 12 is a metal-catalyzed acrylic floor finish having lower wear resistance than topcoat 14. If used alone on floor 10, intermediate coating 12 could readily be stripped from floor 10 using a conventional chemical floor stripping agent. If used alone on floor 10, topcoat 12 would not be strippable (or might only be stripped with difficulty) from floor 10 using such a stripping agent.

Fig. 2 shows a wall 20 overcoated with wallpaper 22 and protective laminate finish 24 containing intermediate coating 26 and topcoat 28. Topcoat 28 is an acrylic latex paint whose wear resistance and durability protect underlying intermediate coating 26, wallpaper 22 and wall 20 from scuffing, abrasion and other wear or damage.

Intermediate coating 26 is a metal-catalyzed acrylic coating having lower wear resistance than topcoat 28. If used alone on wall 20, intermediate coating 22 could readily be stripped from wall 20 using a thickened version of a conventional chemical floor stripping agent. If used alone on wall 20, topcoat 24 would not be strippable (or might only be stripped with difficulty) from wall 20 using such a stripping agent.

Fig. 3 shows the application of chemical stripping agent 30 to the laminate finish 11 of Fig. 1, and Fig. 4 shows the subsequent removal of the softened laminate finish 11. As shown in Fig. 3, agent 30 permeates and penetrates topcoat 14 but does not significantly soften or otherwise attack topcoat 14. On reaching intermediate coating 12, agent 30 causes intermediate coating 12 to soften and break apart. Intermediate coating 12 loosens its bond with floor 10 and begins a gradual disintegration process (illustrated in Fig. 4) that eventually causes intermediate coating 12 and topcoat 14 to break up into small particles such as particles 42, 43 and 44. By using a mop 46 and water 47, the disintegration process can be accelerated. Vacuum 48 facilitates removal of the residue of the laminate finish 11 from floor 12.

A variety of substrates can be coated with the laminate finishes of the invention. For example, flooring materials that can be coated include resilient materials such as vinyl flooring, vinyl composite flooring, and synthetic sports floors; and non-resilient materials such as concrete, marble and wood. Other substrates that can be coated include walls, ceilings, labels, emblems, indoor and outdoor signs, and vehicles such as automobiles.

A variety of intermediate coating materials can be employed. Suitable intermediate coating materials should be strippable using a strip agent that is capable of permeating the topcoat. Thus, the choice of intermediate coating material will be determined in part by the chosen topcoat and stripping agent. Waterborne intermediate coating materials are preferred for ease of application. Water-soluble acid-containing polymers crosslinked using transition metals (e.g., metal crosslinked acrylics) are a particularly preferred class of intermediate coating materials. These can be stripped using a variety of strip agents (described in more detail below) that dissolve the intermediate coating or attack the crosslinking site. Preferred intermediate coatings will have a rating of 6 or more, more preferably a rating of 7, when coated alone on a vinyl composite tile substrate and evaluated using second Strippability Evaluation Method (7 point scale), using Test Strip Agent K and a 10 minute strip agent standing time. Suitable

commercially available metal crosslinked acrylic polymers include Gemstar Laser™ and Taj Mahal™ acrylic finishes from Ecolab Inc.; High Noon™ acrylic finish from Butchers; Citation™ acrylic finish from Buckeye International, Inc., Signature™, Vectra™, and Complete™ acrylic finishes from SC Johnson Professional Products; Upper Limits™ acrylic finish from Spartan Chemical Co.; and materials such as those described in U.S. Patent Nos. 4,517,330 and 5,319,018 and the patents cited therein. Strippable floor coatings designated as "sealers" (e.g., Over and Under™ floor sealer, available from S. C. Johnson Professional Products) and strippable coatings based on polyvinylacetates could also be used. If desired, two or more layers of different intermediate coatings can be employed in laminate finishes of the invention, in order to optimize properties such as adhesion to the substrate or to the topcoat, wear resistance, strippability, etc.

A variety of topcoat materials can be used in the invention. Suitable topcoat materials should be less strippable than the intermediate coating, and should be permeable by a chemical strip agent that is capable of stripping the intermediate coating material. Thus, the choice of topcoat material will be determined in part by the chosen intermediate coating material and stripping agent. Preferred topcoat materials will have a rating of 5 or less, and more preferably a rating of 3 or less, if coated alone on a vinyl composite tile substrate and evaluated using the second Strippability Evaluation Method (7 point scale), Test Strip Agent K and a 10 minute strip agent standing time. When the intermediate coating and topcoat are each coated alone and compared using such an evaluation method, they preferably will have at least a 1 point differential, more preferably at least a 2 point differential, and most preferably at least a 4 point differential in observed strippability rating values.

Polymerizable topcoat materials (e.g. two-part thermally curable or one-part photocurable materials) are preferred due to their durability. In addition, topcoat materials that are waterborne or otherwise substantially solvent free (e.g., 100 percent solids low viscosity formulations) are preferred for environmental reasons. Preferably the topcoat is not metal crosslinked. Suitable topcoat materials include urethanes, acrylics, epoxies, melamines and blends or copolymers thereof. Waterborne UV curable acrylates and urethanes are particularly preferred topcoat materials. These tend to be less strippable and more wear resistant than the metal crosslinked acrylic intermediate coatings mentioned above, and are permeable by strip agents that can be used to remove such intermediate coating materials. Suitable commercially or experimentally available

topcoat materials include UV curable acrylates, urethanes and urethane acrylates (including aliphatic polyester urethane acrylates) such as the materials designated as 935-63 through 935-67; 935-75B; 935-76 and 935-80 through 935-82 series of UV curable coatings from UV Coatings Limited; RoShield™ 3120 UV curable acrylate coating from Rohm & Haas; and NeoRad™ NR-3709 UV curable aliphatic urethane coating from Zeneca Resins, and materials such as those described in U.S. Patent No. 5,453,451 and 5,773,487. A variety of other coating resins that can be cured using suitable crosslinking agents, thermal initiators or photoinitiators can be employed, including Courtmaster II™ waterborne acrylic urethane, available from Ecolab, Inc.; Laromer™ PE 55W polyester acrylate, LR 8895 polyester acrylate, LR 8949 aliphatic urethane and LR 8983 aromatic urethane waterborne acrylic ester resins, all available from BASF Corp.; Viaktin™ VTE 6155 aliphatic urethane acrylate, VTE 6165 aromatic urethane acrylate and VTE 6169 aliphatic polyester urethane radiation curing resins, all available from Vianova Resins GmbH &Co. KG; 98-283W urethane acrylate, available from Hans Rahn & Co.; and materials such as those described in U.S. Patent No 5,830,937. If desired, two or more layers of different topcoats can be employed in laminate finishes of the invention, in order to optimize properties such as adhesion to the intermediate coating, laminate surface appearance or properties, wear resistance, strippability, etc.

Suitable strip agents include compositions containing phenyl alcohols (e.g., benzyl alcohol); glycol ethers (e.g., propylene glycol methyl ether; phenoxy ethanol; phenoxy propanol; and Ethyl Carbitol™, Butyl Carbitol™ and Butyl Cellosolve™, all available from Union Carbide Corp.); metasilicates; alkanolamines (e.g., monoethanolamine); and caustic agents such as sodium or potassium hydroxide. Compositions containing phenyl alcohols are preferred for laminate finishes employing acrylate or urethane topcoats owing to the relatively high rate at which phenyl alcohols penetrate such topcoats and their ease of use and low odor.

A particularly preferred strip agent concentrate contains a polar solvent that is denser than water, and a sufficiently low level of cosolvent or surfactant so that upon mixing with water a pseudo-stable aqueous dispersion forms which will phase-separate following application to a surface.

Another preferred strip agent concentrate contains about 1 to 75 wt. percent of an ether alcohol solvent having a solubility in water of less than about 5 wt. % of the solvent, and about 1 to 75 wt. % of an ether alcohol solvent/coupler having a solubility in water of

about 20 to about 100 wt. % of the solvent coupler, wherein the vapor pressure of the concentrate is less than 1 millimeter Hg. Concentrates of this type are described in copending application Serial No. 09/383.000 filed August 25,1999, the disclosure of which is incorporated by reference.

Suitable commercially available strip agents include Hawk™, Freedom™ and Care Strip Low Odor™ stripper concentrates from Ecolab, Inc.; Juggernaut™ stripper concentrate from Buckeye International, Inc.; Fuller 3100™ Super Concentrate from H. B. Fuller, Inc. and Twist and Fill™ stripper concentrate from 3M.

The intermediate coating, topcoat and strip agent can contain a variety of adjuvants to alter the performance of properties of each component before or after application to a substrate. Useful adjuvants include leveling agents and other surface-active agents, defoamers, solvents to accelerate or to slow the drying rate, waxes, fillers, indicators and colorants. They types and amounts of such adjuvants will be apparent to those skilled in the art.

The compositions of the invention can be applied using a variety of methods, including spraying, brushing, roll coating and flood coating. Mop application is preferred for coating floors. Typically the substrate should first be cleaned and any loose debris removed. One or more coats of the intermediate coating (diluted if necessary with water or another suitable solvent) are applied to the substrate, and allowed to dry. Three to five coats of the intermediate coating typically will be preferred for coating floors. When used on floors, each coat of the intermediate coating preferably will have a dry coating thickness of about 2.5 to about 75 micrometers, more preferably about 2.5 to about 20 micrometers, and the overall intermediate dry coating thickness preferably will be about 5 to about 38 micrometers, more preferably about 5 to about 20 micrometers.

Next, one or more coats of the topcoat (diluted if necessary with water or another suitable solvent) can be applied to the intermediate coating as soon as the intermediate coating has dried to the touch. The topcoat is applied, and cured or allowed to dry or harden. Three to five coats of the topcoat typically will be preferred for coating floors. When used on floors, each coat of the topcoat preferably will have a dry coating thickness of about 2.5 to about 75 micrometers, more preferably about 2.5 to about 20 micrometers, and the overall topcoat dry coating thickness preferably will be about 5 to about 38 micrometers, more preferably about 5 to about 20 micrometers. When used on floors, the

laminate finish preferably will have an overall dry coating thickness of about 10 to about 75 micrometers, more preferably about 12 to about 38 micrometers.

The laminate finish composition can thereafter receive normal maintenance until such time as it is desired to remove and renew the laminate finish. The laminate finish can be stripped by optionally abrading the topcoat with a suitably mild abrasive (e.g., a green or black Scotch-Brite™ Floor Maintenance pad from 3M) and then applying a coating of the desired strip agent. The strip agent should be allowed to stand for a suitable time (e.g., for a minute or more, and typically between about 5 and about 15 minutes) while it permeates through the topcoat and attacks the intermediate coating. After the finish softens sufficiently, it can be removed using a variety of techniques including vacuuming, mopping or wiping. Removal will usually be made easier if water or a suitable detergent solution is applied to the softened finish. The substrate can be allowed to dry and new layers of the intermediate coat and topcoat can be applied to renew the laminate finish.

The compositions of the invention typically will be sold in the form of a kit containing the intermediate coating and topcoat in containers (e.g., separate containers) together with suitable directions for carrying out the methods of the invention. If desired, the intermediate coating or topcoat could be packaged as concentrates intended to be typically will be mixed with water or another suitable solvent at about a 15 – 40 % solids level. Optionally the kit will include a container of the strip agent. The strip agent typically will be mixed with water or another suitable solvent at about a 5 – 30 % by weight. The kit can also contain undercoat materials (e.g., leveling coatings) that can be applied to the substrate before application of the intermediate coating, and overcoat materials (e.g., wax finishes) that can be applied atop the topcoat.

The invention is further illustrated in the following non-limiting examples, in which all parts and percentages are by weight unless otherwise indicated. In the examples the following procedures were employed:

Substrate Coating Procedure

A set of 150 mm square white or black vinyl composite floor tiles from Armstrong Tile or from American Biltrite Limited were coated with 2 coats of a waterborne metal-catalyzed acrylic floor finish (Gemstar Laser™, Ecolab Inc.) applied at a 20% solids level. Tiles coated only with this acrylic floor finish can readily be stripped in less than

30 minutes using all of the Test Strip Agents listed below. Each coat was allowed to air dry before application of the second coat. The total coating thickness after the second coat had dried was about 10 micrometers (at 5 micrometers per coat). This first set of coated tiles and a second set of uncoated tiles were next coated with various waterborne UV curable coating formulations. The UV curable coating formulations were applied at a 30% solids level with each coat being allowed to air dry before application of the next coat. Two coats of the UV curable coating formulation were applied to each of the metal-catalyzed acrylic floor finish coated tiles in the first set. The total dried coating thickness for these two UV curable coats was about 15 micrometers (at 7.5 micrometers per coat), yielding a combined coating thickness of about 25 micrometers. Three coats of the UV curable coating formulation were applied to each of the uncoated tiles in the second set. The total dried coating thickness for these three UV curable coats was about 22.5 micrometers (at 7.5 micrometers per coat). Thus the two sets of tiles were coated to nearly similar overall thicknesses, at 25 micrometers for the tiles in the first set and 22.5 micrometers thickness for the tiles in the second set. Both sets of tiles were passed through a UV curing apparatus containing an H bulb mercury vapor lamp operated at 1935 joule/sec per cm^2 and 4.9 meters per minute.

Test Strip Agents

Aqueous solutions of the following Test Strip Agents diluted with deionized water were used in the examples:

Test Strip Agent A:	Concentrate[1] at 1:9 dilution (10% in water)
Test Strip Agent B:	Concentrate[2] at 1:9 dilution (10% in water); formed a clear solution
Test Strip Agent C:	Concentrate[2] at 1:4 dilution (20% in water); formed a cloudy solution
Test Strip Agent D:	Concentrate[3] at 1:9 dilution (10% in water)
Test Strip Agent E:	Concentrate[3] at 1:4 dilution (20% in water)
Test Strip Agent F:	Concentrate[4] at 1:9 dilution (10% in water)
Test Strip Agent G:	Concentrate[4] at 1:5 dilution (20% in water)
Test Strip Agent H:	Concentrate[5] at 1:9 dilution (10% in water)
Test Strip Agent I:	Concentrate[5] at 1:4 dilution (20% in water)
Test Strip Agent J:	Concentrate[1] at 1:4 dilution (20% in water)
Test Strip Agent K:	Dilute solution[6]

Test Strip Agent L: Concentrate[7] at 1:4 dilution (20% in water)

[1] Concentrate containing 30 wt.% diethylene glycol monobutyl ether, 30 wt.% dipropylene glycol N-butyl ether, 30 wt.% propylene glycol phenyl ether and 10 wt.% "Surfonic 24-9" ethoxylated alcohol (Huntsman Chemical).

[2] Concentrate containing 49% benzyl alcohol, 17% monoethanolamine, 24% water and 10% sodium decyldiphenyl ether disulfonate.

[3] Juggernaut™ stripper concentrate from Buckeye International, Inc.

[4] Concentrate containing 44 % benzyl alcohol, 32% monoethanolamine, 10% decanoic fatty acid, 11% octanoic fatty acid, 2% water and < 1% Dequest™ 2010 hydroxyethylidene diphosphonic acid (Solutia Inc.).

[5] Concentrate containing 75 wt.% benzyl alcohol, 7.5 wt.% diethylene glycol monobutyl ether, 7.5 wt.% dipropylene glycol N-butyl ether, 7.5 wt.% propylene glycol phenyl ether and 2.5 wt.% "Surfonic 24-9" ethoxylated alcohol (Huntsman Chemical).

[6] Dilute solution made at a 1:3 dilution (25% in water) from a concentrate containing 59% softened water, 6% sodium xylene sulfonate, 4.5% potassium hydroxide, 10% monoethanolamine, 0.2% tetrasodium EDTA, 10% ethylene glycol phenyl ether and 0.05% fluorosurfactant (FC-129, 3M).

[7] Concentrate containing 48.5% benzyl alcohol, 40.75% monoethanolamine, 10.1% dinonylphenol ethoxylate (with an average of 10 EO units), and 0.15% "FC-120" fluorinated wetting agent (3M)

First Strippability Evaluation Method (6 Point Scale)

Coated tiles were placed on a level surface and flooded with a sufficient quantity of a 10% aqueous solution of Test Strip Agent A to form a 50 mm diameter circular pool on the surface of each coated tile. The Test Strip Agent solution was allowed to remain on the tiles for approximately 20 minutes. Using light and consistent pressure, a nonwoven abrasive scrub pad (Scotch-Brite™ green abrasive, 3M) was used make 10 circular rubs on each tile. The tiles were rinsed with tap water, blotted dry and rated according to the following scale:

1) No effect
2) Chemical attack on surface (non tacky)
3) Slight removal in spots or abrasion (random scratches on the surface of the coating)
4) Incomplete strip (may strip completely in some areas, especially where topcoat was porous, but not in other areas. Coating is slightly soft or tacky)
5) Partial strip with softened coating in all areas
6) Complete strip

Second Strippability Evaluation Method (7 point scale)

A 50 mm diameter by 38 mm high carbon steel cylinder with a weight of 571 grams was wrapped with a green nonwoven pad (Scotch-Brite™ Floor Maintenance Disc, 3M). When rolled over a coated tile substrate, the cylinder exerted a pressure of 2.8 kPa and mimicked the pressure applied by a standard electric floor burnisher. The coated tiles were placed on a level surface and flooded with a sufficient quantity of a 15% aqueous solution of various Test Strip Agents to form a 50 mm diameter circular pool on the surface of the coated tiles. The Strip Agent solution was allowed to remain on the coated tiles for 10 minute or 20 minute standing times. The cylinder was then rolled 10 times over each tile. The tiles were rinsed with tap water, blotted dry and rated according to the following scale:

1) No effect
2) Minimal chemical attack on coating
3) Moderate chemical attack on coating
4) Severe chemical attack on coating with onset of stripping
5) Incomplete strip (may strip completely in some areas, especially where coating was porous, but not in other areas. Finish is slightly soft or tacky)
6) Partial strip with softened finish in all areas
7) Complete strip

Example 1

Using the First Strippability Evaluation Method (6 Point Scale) set out above, several waterborne UV curable coating formulations obtained from UV Coatings Limited were applied to tiles and evaluated for strippability with and without the use of a strippable intermediate coating composition between the tile and the topcoat. The results are set out below in Table 1.

Table 1

Run No.	Intermediate coating?	Topcoat	6 Point Scale Evaluation
1-1	No	935-62	1
1-2	Yes	935-62	3
1-3	No	935-63	1
1-4	Yes	935-63	4
1-5	No	935-64	3

Run No.	Intermediate coating?	Topcoat	6 Point Scale Evaluation
1-6	Yes	935-64	5
1-7	No	935-65	4
1-8	Yes	935-65	5
1-9	Yes	935-65[1]	5

[1] Modified by the addition of 0.07% FC-120 fluorinated surfactant, 3M

The results in Table 1 show that for each of the tested UV curable topcoat formulations, strippability was improved when the intermediate coat was present.

Example 2

Using the method of Example 1, a waterborne UV curable coating formulation obtained from UV Coatings Limited (identified as "936-66-2", a 75:25 blend of an aliphatic polyester urethane and an acrylic resin) was applied as a topcoat to vinyl composite tiles, with and without a strippable intermediate coating composition between the tile and the topcoat. Using the Second Strippability Evaluation Method (7 Point Scale), the coatings were evaluated for strippability. Test Strip Agents B and C were employed for 10 minute or 30 minute standing times. The results are set out below in Table 2.

Table 2

Run No.	Intermediate coating?	Test Strip Agent	Standing Time, min	7 Point Scale Evaluation
2-1	No	B	10	2
2-2	Yes	B	10	7
2-3	No	B	30	3
2-4	Yes	B	30	7
2-5	No	C	10	5
2-6	Yes	C	10	7
2-7	No	C	30	4
2-8	Yes	C	30	7
2-9	No	D	10	1
2-10	Yes	D	10	1
2-11	No	D	30	1
2-12	Yes	D	30	5
2-13	No	E	10	1
2-14	Yes	E	10	2
2-15	No	E	30	1
2-16	Yes	E	30	7

Run No.	Intermediate coating?	Test Strip Agent	Standing Time, min	7 Point Scale Evaluation
2-17	No	F	10	2
2-18	Yes	F	10	6
2-19	No	F	30	2
2-20	Yes	F	30	7
2-21	No	G	10	3
2-22	Yes	G	10	6
2-23	No	G	30	3
2-24	Yes	G	30	7
2-25	No	H	10	4
2-26	Yes	H	10	6
2-27	No	H	30	4
2-28	Yes	H	30	7
2-29	No	I	10	4
2-30	Yes	I	10	6
2-31	No	I	30	4
2-32	Yes	I	30	7
2-33	No	A	10	1
2-34	Yes	A	10	1
2-35	No	A	30	1
2-36	Yes	A	30	2
2-37	No	J	10	1
2-38	Yes	J	10	1
2-39	No	J	30	1
2-40	Yes	J	30	4

The results in Table 2 show that for each of the tested UV curable topcoat formulations, strippability was improved when the intermediate coat was present. The laminate finish formulations were completely strippable with most of the Test Strip Agents, whereas the corresponding topcoat was not completely strippable with any of the Test Strip Agents. Complete stripping of the laminate finish formulations was achieved in less than 6 minutes using Test Strip Agent B, and in less than 1 minute using Test Strip Agent C.

Example 3

Two waterborne UV curable coating formulations were prepared from the ingredients set out below in Table 3:

Table 3

Ingredient	Formulation A, Parts	Formulation B, Parts
Viaktin™ VTE 6165 resin[1]	42.86	
Viaktin™ VTE 6169 resin[2]		42.86
Irgacure 500 photoinitiator[3]	1.57	1.57
Wax 325 polymer emulsion[4]	1.05	0.53
Wax 43N polymer emulsion[4]	1.05	1.58
PI-35 defoamer[5]	0.1	0.1
FC-120 fluorosurfactant[6]	0.05	0.05
Deionized water	53.32	53.32

---

1 Aromatic urethane acrylate radiation curing resin, available from Vianova Resins GmbH &Co. KG

2 Aliphatic polyester urethane radiation curing resins, available from Vianova Resins GmbH &Co. KG

3 Available from Ciba-Geigy Company

4 Available from Emulsion Systems, Inc.

5 Available from Ultra Additives, Inc.

6 Available from 3M

Using the method of Example 1, these compositions were applied as topcoats to vinyl composite tiles, with and without a strippable intermediate coating composition between the tile and the topcoat. Using the Second Strippability Evaluation Method (7 Point Scale), the coatings were evaluated for strippability. Test Strip Agent L was employed for a 10 minute standing time. The results are set out below in Table 4.

Table 4

Run No.	Intermediate coating?	Topcoat	Test Strip Agent	7 Point Scale Evaluation
3-1	No	A	L	2
3-2	Yes	A	L	7
3-3	No	B	L	2
3-4	Yes	B	L	7

Various modifications and alterations of this invention will be apparent to those skilled in the art without departing from the scope and spirit of this invention. It should be understood that this invention is not limited to the illustrative embodiments set forth above.